Principles of hemotherapy, transfusions

MUDr.Pavlína PIŤHOVÁ, Ph.D.
INTERNÍ KLINIKA UK 2.LF

Whole blood and blood components

- Prepared from Whole blood collection or apheresis
- Whole blood is separated by differential centrifugation
  - Red Blood Cells (RBC's)
  - Platelets – buffy coat or apheresis
  - Plasma – buffy coat or apheresis
    - Cryoprecipitate – „fresh frozen plasma"
    - Others
- Others include Plasma proteins—IVIg, Coagulation Factors, albumin, Anti-D
- Apheresis may also used to collect blood components

Whole Blood

- Storage
  - 4° for up to 35 days
- Indications
  - Massive Blood Loss/Trauma/Exchange Transfusion
- Considerations
  - Donor and recipient must be ABO identical

RBC Concentrate

- Storage
  - 4° for up to 42 days, can be frozen
- Indications
  - Many indications—anemias of many types, etc.
- Considerations
  - Recipient must not have antibodies to donor RBC's (note: patients can develop antibodies over time)
  - Usually transfuse over 2-4 hours (slower for chronic anemia)

Blood group system

Aglutinogens in RBC	
A	Aglutinogen A
B	Aglutinogen B
0	No aglutinogen
AB	Aglutinogen A + B

Aglutinins in plasma	
A	Aglutinin anti B
B	Aglutinin anti A
0	Aglutinin anti A + anti B
A B	No aglutinin

Lab before transfusion

- Blood group AB0
- Blood group Rh system
- „large cross-match-reaction“

  - reaction between RBC of the donor and plasma of recipient
- „small cross-match-reaction“

  - reaction between plasma of donor and RBC of recipient

The transfusion and the recipient must have the same blood group!!!

Transfusion application

Hemotherapy

substitution of a part of blood (cells, plasma)

physician is responsible for correct and proper use!!
Cave! Transfusion could kill!!!

We start with transfusion indication

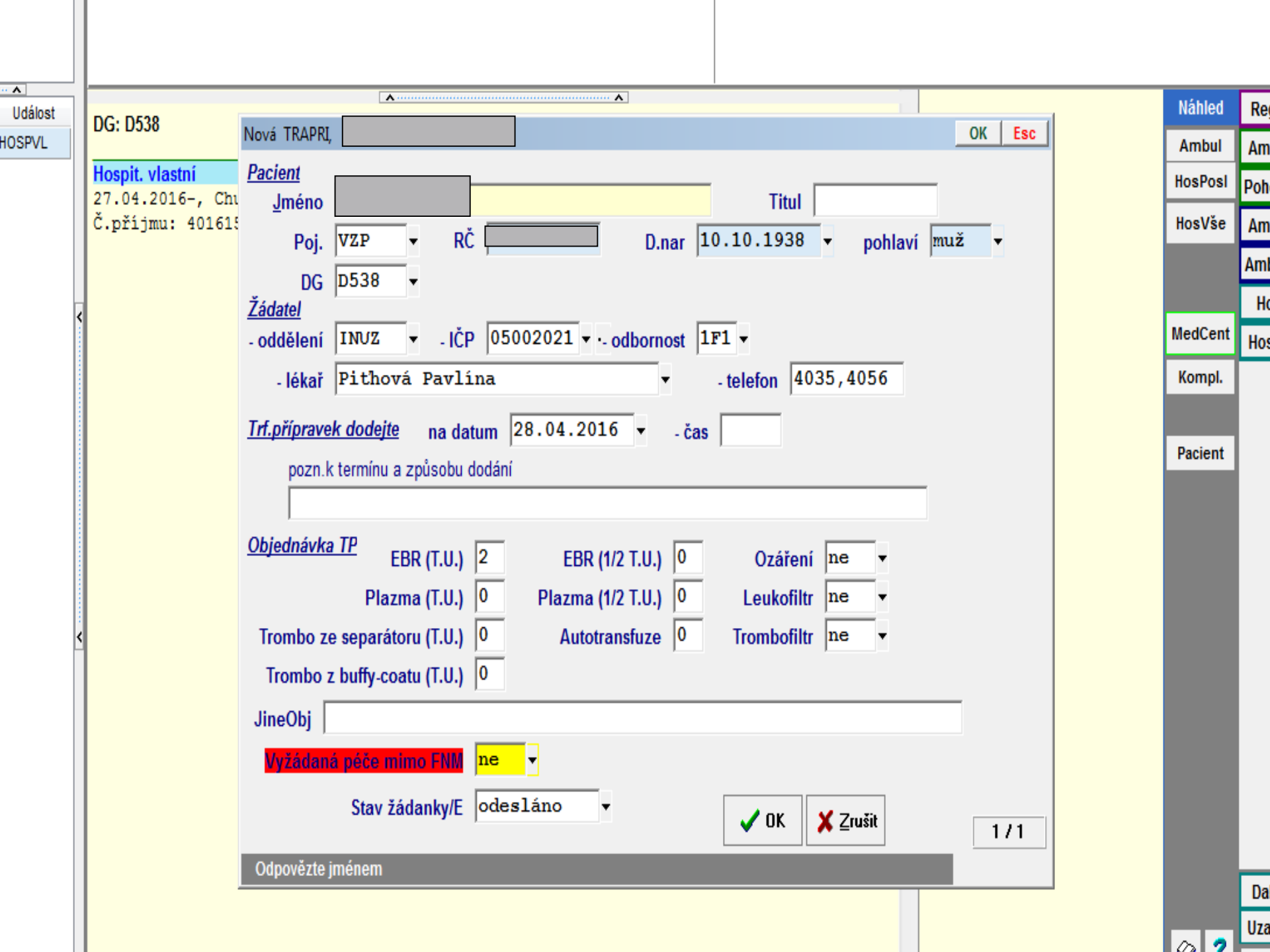
- Depends on blood cell count and clinical presentation - symptoms
- Anemia, blood loss
- 1 TU of RBC increases the Hb level about 10-12g/l

- Hb < 70 g/l + symptoms of anemia
- Hb < 100 g/l in patients with severe cardiac or cerebral vascular insufficiency
- Hb < 80g/l before minor surgery or < 100 g/l before major surgery

Order of transfusion preparation

Blood preparation order

- Indication of transfusion – description in patient record
- Informed consent signature
- Recquisition form (PC):
  - Patient identification
  - Diagnose
  - Pre-transfusion examination request
  - Choice of blood preparation
  - Needed time
- Blood sample collection and


Událost
HOSPVL
DG: D538
Hospit. vlastní
27.04.2016-, Chu
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Nová TRAPRI,
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Trf.přípravek dodejte
na datum
28.04.2016
- čas
pozn.k termínu a způsobu dodání
Objednávka TP
EBR (T.U.)
2
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0
Ozáření
ne
Plazma (T.U.)
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Plazma (1/2 T.U.)
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Leukofiltr
ne
Trombo ze separátoru (T.U.)
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Autotransfuze
0
Trombofiltr
ne
Trombo z buffy-coatu (T.U.)
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JineObj
Vyžádaná péče mimo FNM
ne
Stav žádanky/E
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OK
Zrušit
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Odpovězte jménem
Náhled
Ambul
HosPosl
HosVše
MedCent
Kompl.
Pacient

Pre-transfusion examination in blood bank

- Blood group AB0 and RhD in all recipients
- Screening of antibodies in repeated transfusion
- Cross tests

- Prepaired transfusion is stored max. for 48hours
- Brought in thermo-box to the department
- App 30 min warming in room

Transfusion preparation

Transfusion preparation

- **Check the documents–** blood group, patient identification, validity of compatibility tests (48hours)
- **Identification** and instruction of the recipient
- **Check the blood preparation** - type, correspondence of label and documents, blood group, visible control of the preparation

Examination immediatelly before transfusion

- NURSE:
- Blood pressure, heart rate
- Temperature
- Urine test
- PHYSICIAN:
- Check the documents
- Informed consent
- Identification and instruction of the recipient

Bedside blood group test – „sanguitest“

Transfusion application

- „Biological test“
- Physician must be present in first 15-20min, then the nurse is checking the patient every 15min
- 60-80 drops/min
- 1 TU cca 2 hours
- The patient must be instructed about possibility of some reactions
- Stop the transfusion immediatelly if reaction occurs
- Signalling

End of transfusion

End of transfusion

- Last 10 ml
- Bag+sets+sanguitest
- Kept in specialized fridge for 24 hours
- Check the patient:
- Blood pressure, heart rate, temperature, urine test
- Follow-up for 2-4 hours

Transfusion Complications

- Acute Transfusion Reactions (ATR's)
- Chronic Transfusion Reactions
- Transfusion related infections

Acute Transfusion Reactions

- Hemolytic Reactions (AHTR)
- Febrile Reactions (FNHTR)
- Allergic Reactions
- Coagulopathy in case of massive transfusions
- Bacteriemia

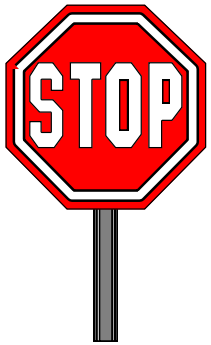
Acute Hemolytic Transfusion Reactions (AHTR)

- Occurs when incompatible RBC's are transfused into a recipient who has pre-formed antibodies (usually ABO or Rh)
- Antibodies activate the complement system, causing intravascular hemolysis
- Symptoms occur within minutes of starting the transfusion
- **1-2 ccm of incompatibile RBC's** could cause this reaction!!!
- Labeling error is most common problem
- **Can be fatal**

Symptoms of AHTR

- High fever/chills
- Hypotension
- Back/abdominal pain
- Oliguria
- Dyspnea
- Dark urine
- Pallor

What to do?
If an AHTR occurs



- **STOP TRANSFUSION**
- Maintain IV access and run IVF
- Monitor and maintain BP/pulse
- Give diuretic
- Collect blood and urine for transfusion reaction workup
- Send remaining blood back to Blood Bank

Febrile Nonhemolytic Transfusion Reactions (FNHTR)

- Definition--Rise in patient temperature >1°C (associated with transfusion without other fever precipitating factors)
- Occurs with approx 1% of RBC transfusions and approx 20% of Plt transfusions
- FNHTR caused by alloantibodies directed against HLA antigens

Allergic Nonhemolytic Transfusion Reactions

- Etiology
  - May be due to plasma proteins or blood preservative/anticoagulant
- Presents with urticaria and wheezing
- Treatment
  - Mild reactions—Can be continued after anti-histamin treatment
  - Severe reactions—Must STOP transfusion and may require steroids or epinephrine
- Prevention—Premedication (Antihistamines)

Massive Transfusions

- Coagulopathy may occur after transfusion of massive amounts of blood (trauma/surgery)
- Coagulopathy is caused by failure to replace plasma
- See electrolyte abnormalities
  - Due to citrate binding of Calcium
  - Also due to breakdown of stored RBC's

Bacterial Contamination

- More common and more severe with platelet transfusion (platelets are stored at room temperature)
- Organisms
  - Platelets—Gram (+) organisms, ie Staph/Strep
  - RBC's—Yersinia, enterobacter
- Risk increases as blood products age (use fresh products for imunnocompromised patients)

Chronic Transfusion Reactions

- Alloimmunization
- Transfusion Associated Graft Verses Host Disease (GVHD)
- Iron Overload
- Transfusion Transmitted Infection

Iron overload

- 1 T.U. = 200-250mg Fe
- Physiological daily loss = 1-2mg (enterocytes, urine, gall)
- More than 20 T.U. = iron overload (thalassemia, MDS) - risk of hemochromatosis – accumulation of iron in liver, endocrine organs, heart
- Increase of transferin saturation - non-transferrin bound iron (NTBI) and very toxic (but chelatable) labile plasma iron (LPI) – peroxidation of membranes, DNA, cell apoptosis, disturbances of endocrine organs, liver failure, congestive heart failure
- Feritin > 1000ug/l + > 20T.U. = indication for chelating therapy as chronic part of treatment (deferoxamine, deferipron, deferasirox) – binds LPI and removes it from circulation

Plasma application

Plasma – buffer coat or apheresis

- Fresh frozen plasma
- 6 month quarantine – the donor is screened for infectious diseases after 6 month – only after test is possible to use the plasma – HIV, HBV, HCV, syphillis
- Albumin, immunoglobulins, coagulation factors
- Indication: bleeding, hypocoagulation before surgical procedures, severe hypoalbuminaemia
- Donor and recipient must be of the same blood group AB0 (not Rh)

Platelets

Platelets

- Same group in AB0 and Rh
- Buffer coat or apheresis
- Minimum is usually 4-6 T.U./patient – $200x10^9/l$
- Indication: trombocytopenia
- Stored only up to 5 days